PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Yasuhiro FUJIWARA, et al.

Docket No: Q91049

Appln. No.: 10/826,308

Group Art Unit: 1755

Confirmation No.: 1322

Examiner: Elizabeth A. BOLDEN

Filed: April 19, 2004

For: OPTICAL GLASS; PRESS-MOLDING PREFORM AND METHOD OF MANUFACTURING THE SAME; AND OPTICAL ELEMENT AND METHOD OF MANUFACTURING THE SAME

DECLARATION UNDER 37 C.F.R. § 1.132

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Yasuhiro FUJIWARA, hereby declare and state:

THAT I am a citizen of Japan;

THAT I have received the degree of Masters in Chemistry in 2000 from Keio University, Japan;

THAT I have been employed by HOYA Corporation since April 2000, where I hold a position as a researcher, with responsibility for research and development in the field of optical glasses;

THAT I am an inventor of the above-identified application;

THAT I am familiar with the above-identified application, and with US Publication 2002/0073735 to Hayashi et al.;

THAT I have conducted the following experiments to demonstrate the unexpectedly superior results of the presently claimed invention *vis-à-vis* Hayashi;

EXPERIMENTAL REPORT

I. Glass preparation

Glass No. 22 described in Table 5 of Hayashi (US2002/0073735A1) was selected as a base glass. To the base glass, various amount of Bi_2O_3, WO_3, Nb_2O_5 or TiO_2 were added. The compositions of each glass prepared were shown in Table A.

In Table A, the abbreviation, "B2" means the glass that was prepared by adding Bi_2O_3 to the base glass in an amount so that the resulting glass comprised 2 cationic percent of Bi^{3+}. The same is true on the abbreviations, B4 and B6.

The abbreviation, "W2" means the glass that was prepared by adding WO_3 to the base glass in an amount so that the resulting glass comprised 2 cationic percent of W^{6+}. The same is true on the abbreviations, W4 and W6.

The abbreviation, "N2" means the glass that was prepared by adding Nb_2O_5 in an amount so that the resulting glass comprised 2 cationic percent of Nb^{5+}. The same is true on the abbreviations, N4 and N6.

The abbreviation, "T2" means the glass that was prepared by adding TiO_2 to the base glass in an amount so that the resulting glass comprised 2 cationic percent of Ti^{4+}. The same is true on the abbreviations, T4 and T6. However, Glass T2, T4 and T6 could not be prepared because they were not vitrified but crystallized.

Table A is set forth on the following page

No.			P_2O_5	B_2O_3	SiO_2	Li_2O	Na_2O	K_2O	BaO	ZnO	TiO_2	Nb_2O_5	Bi_2O_3	WO_3	Total
BASE	Hayashi No.22	mol%	24.00	3.00	0.00	22.00	11.00	2.00	3.00	3.00	6.00	18.00	0.00	8.00	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	0.00	4.44	100.00
T2	Ti+2cat%	mol%	23.17	2.90	0.00	21.24	10.62	1.93	2.90	2.90	8.27	17.37	0.00	7.72	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	5.31	20.00	0.00	4.44	102.00
T4	Ti+4cat%	mol%	22.39	2.80	0.00	20.52	10.26	1.87	2.80	2.80	12.31	16.79	0.00	7.46	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	7.31	20.00	0.00	4.44	104.00
T6	Ti+6cat%	mol%	21.66	2.71	0.00	19.85	9.93	1.81	2.71	2.71	15.14	16.25	0.00	7.22	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	9.31	20.00	0.00	4.44	106.00
N2	Nb+2cat%	mol%	23.68	2.95	0.00	21.61	10.81	1.96	2.95	2.95	5.69	18.45	0.00	7.88	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	22.00	0.00	4.44	101.00
N4	Nb+4cat%	mol%	23.17	2.90	0.00	21.24	10.62	1.93	2.90	2.90	5.79	20.85	0.00	7.72	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	24.00	0.00	4.44	104.00
N6	Nb+6cat%	mol%	22.77	2.85	0.00	20.87	10.44	1.90	2.85	2.85	5.69	23.20	0.00	7.59	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	26.00	0.00	4.44	106.00
BASE	Hayashi No.22	mol%	24.00	3.00	0.00	22.00	11.00	2.00	3.00	3.00	6.00	18.00	0.00	8.00	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	0.00	4.44	100.00
W2	W+2cat%	mol%	23.17	2.90	0.00	21.24	10.62	1.93	2.90	2.90	5.79	17.37	0.00	15.30	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	0.00	8.44	102.00
W4	W+4cat%	mol%	22.39	2.80	0.00	20.52	10.26	1.87	2.80	2.80	5.60	16.79	0.00	14.94	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	0.00	8.44	104.00
W6	W+6cat%	mol%	21.66	2.71	0.00	19.86	9.93	1.81	2.71	2.71	5.42	16.25	0.00	14.47	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	0.00	10.44	106.00
B2	Bi+2cat%	mol%	23.68	2.95	0.00	21.61	10.81	1.96	2.95	2.95	5.89	17.69	1.77	7.86	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	2.00	4.44	102.00
B4	Bi+4cat%	mol%	23.17	2.90	0.00	21.24	10.62	1.93	2.90	2.90	5.79	17.37	3.47	7.72	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	4.00	4.44	104.00
B6	Bi+6cat%	mol%	22.77	2.85	0.00	20.87	10.44	1.90	2.85	2.85	5.69	17.08	5.12	7.59	100.00
		cat%	26.67	3.33	0.00	24.44	12.22	2.22	1.67	1.67	3.33	20.00	6.00	4.44	106.00

II. Evaluations of the glasses prepared

Measurements of glass transition temperature, liquid phase temperature, refractive index (nd) and Abbé number (νd) were carried out with respect to Glasses B2, B4, B6, W2, W4, W6, N2, N4 and N6 that were successfully prepared.

Furthermore, in order to evaluate the glass stability, the above glasses were kept at 920 degrees Celsius to observe the glass and evaluate based on the following three-grade scale. This test will be referred to as "glass stability test", hereinafter.

A: No crystal was precipitated.

B: Some crystals were precipitated.

C: Glass was crystallized.

Results were shown in the following Tables.

Table B

Glass transition temperature Tg (°C)

Cationic %	Bi	W	Nb	Ti
0	477(BASE)	477(BASE)	477(BASE)	477(BASE)
2	462.1(B2)	481.9(W2)	484(N2)	---
4	457.3(B4)	482.5(W4)	492(N6)	---
6	450.9(B6)	480.7(W6)	496.6(N6)	---

Table C

Liquid phase temperature LT(Tl)

Cationic %	Bi	W	Nb	Ti
0	900(BASE)	900(BASE)	900(BASE)	900(BASE)
2	904(B2)	905(W2)	917(N2)	---
4	918(B4)	913(W4)	937(N6)	---
6	927(B6)	926(W6)	1008(N6)	---

Table D

Results of glass stability test

Cationic %	Bi	W	Nb
0	A	A	A
2	A	A	C
4	A	A	C
6	B	B	C

Table E

	Bi		W		Nb	
Cationic %	nd	vd	nd	vd	nd	vd
0	1.82121	24.01	1.82121	24.01	1.82121	24.01
2	1.83970	23.44	1.83306	23.45	1.83673	23.33
4	1.85624	22.97	1.84419	23.00	1.85044	22.79
6	1.87114	22.57	1.85450	22.56	1.86509	22.22

III. Results

(1) Glass transition temperature

As described in [0003] of the Specification of the present application, lower glass transition temperature is preferred when the glass is employed for precision press molding.

As shown in Table B, Glasses B2, B4 and B6 exhibited lower glass transition temperatures than glasses to which WO_3 or Nb_2O_5 was added instead of Bi_2O_3. From these results, it can be concluded that Glasses B2, B4 and B6 in which Bi_2O_3 is included are suitable for use in precision press molding.

(2) Glass stability

The lower the liquid phase temperature, the better the glass stability. As shown in Table C, Glasses B2, B4 and B6 exhibited lower liquid phase temperature than glasses to which WO_3 or Nb_2O_5 was added instead of the same amount of Bi_2O_3.

Furthermore, as shown in Table D, glasses to which Bi_2O_3 was added exhibited good results in the glass stability test.

From these results, it can be concluded that glasses to which Bi_2O_3 was added have good glass stability.

(3) Optical properties

As shown in Table E, Glasses B2, B4 and B6 exhibited high Abbé numbers (νd), that is, high dispersion. Furthermore, Glasses B2, B4 and B6 exhibited higher refractive index than glasses to which WO_3 or Nb_2O_5 was added instead of the same amount of Bi_2O_3.

IV. Conclusion

In general, when the content of glass component imparting high refractive index to the glass is increase to obtain glass having high refractive index, the glass obtained tends to exhibit deteriorated glass stability, increased liquid phase temperature. As shown in the experimental results, Nb_2O_5 and TiO_2 are such components.

However, as shown above, Bi_2O_3 and WO_3 can impart high refractive index to the glass without deterioration of the glass stability.

Furthermore, among Bi_2O_3 and WO_3, Bi_2O_3 can remarkably increase the refractive index of the glass as well as decrease the glass transition temperature.

From these results, it can be concluded that addition of Bi_2O_3 yields unexpected results in that optical glass that exhibits high refractive index and high dispersion, as well as possesses excellent stability and is suitable for use in precision press molding property can be obtained.

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Da te: Jun e 12, 2007

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